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REMARKS

Claims 1-45 are currently pending. Claims 11-13 and 20-44 were withdrawn from consideration. Claims 1-10, 14-19, and 45 stand rejected. Claims 1 and 4 have been amended. Support for the amendments can be found throughout the claims and the specification, for example, in original Claim 4, and paragraphs 0023, 0024, 0039, 0082, 0099, and 0113. The amendments add no new material.

Rejection of Claims 1-4 and 14-16 under 35 U.S.C. §103(a)

The Examiner has rejected Claims 1-4 and 14-16 under 35 U.S.C. §103(a) as being unpatentable over Shang et al. (hereinafter “Shang”) in view of Igarashi et al., U.S. Patent 5,031,571 (hereinafter “Igarashi”), and Iyer et al. (hereinafter “Iyer”). The Examiner asserts that Shang teaches stainless steel piping 57 that is “not corroded by the activated cleaning gas species.” The Examiner further asserts that Igarashi discloses a capacitively coupled RF plasma source with an exposed aluminum alloy chamber. The Examiner asserts that one would have combined the two references because the structure in Igarashi was shown to be a suitable means by which to energize gas into plasma. Furthermore, the Examiner asserts that Iyer teaches a frequency of 10 kHz to 200 MHz and that this range would have encouraged one of skill in the art to use the recited frequencies of between about 300 and about 500kHz because the frequencies are shown to be suitable for creating reactive species. The Applicants respectfully disagree.

As an initial point, Applicants note that the Examiner’s characterization of the references is overly broad and that the references do not actually describe what the Examiner has asserted they describe. For example, Shang does not actually teach a piping surface that is not corroded by the activated cleaning gas. Shang only teaches piping made of stainless steel. As stated in the present application,¹ stainless steel surfaces can be corroded by activated fluorine cleaning gas. While a fluorine-passivated stainless steel is not corroded by activated fluorine, normal stainless

¹ “Furthermore, if the internal surface of the piping that brings fluorine active species into the reaction chamber is made of stainless steel, aluminum, or aluminum alloy, fluoride is formed due to reaction between the surface within the piping and fluorine active species, and the amount of fluorine active species brought into the reaction chamber is decreased.” (See 0039)

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steel is corroded. This is discussed in greater detail below. However, Applicants note that neither Shang nor Iyer teach piping that will not be corroded by the cleaning gas.

Applicants note that the Office Action has failed to establish a *prima facie* case of obviousness in regard to Claim 1. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Finally, there must be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. (See, *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)).

The Combination of the References Does Not Teach All of the Elements

First, as noted above, none of the references, or any combination thereof, teaches the type of piping that will not be corroded by the cleaning gas. All that has been asserted is that stainless steel can be used. As noted above, the internal surfaces of the piping, if made of stainless steel, should be fluorine-passivated stainless steel, otherwise the surface will be corroded. The iron in stainless steel is converted, for example, into iron fluoride by the use of activated fluoride as the cleaning gas. Iron fluoride adheres as a powder to the inside of the wall of the pipe and can then spall to produce particles during processing which can influence cleaning speeds and productivity. This problem, and others, are discussed in the application (*e.g.*, 0024 and 0025). To overcome these problems and provide further improvements, Applicants have discovered that if the stainless steel is fluorine-passivated in advance, then the problem is eliminated or greatly reduced, which in turn leads to the recited benefits. As such, Applicants note that the claims recite a combination and benefits not taught in the prior art. Moreover, as described in the application (*e.g.*, 0039), there are important advantages gained from this particular element.

However, to further clarify this point, the elements of Claim 4 have been incorporated into Claim 1 so that the term "corrode" can be given its appropriate context. Thus, it is clear that fluorine-passivated stainless steel be used, rather than simply stainless steel.

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The Presented Motivation of "Suitability" is Not Sufficient for the Recited Combination

Throughout the rejection, the Examiner has relied upon the statement that certain items can be combined because they are "suitable for" a purpose. Applicants note that "suitability" is not a general license to state that anything that can be combined or replaced is obvious. Rather, the element must be suitable for an intended purpose. Suitability for an intended purpose is applicable in situations such as "[r]eading a list and selecting a known compound to meet known requirements..." 325 U.S. at 335, 65 USPQ at 301 or where a reference teaches that the element can be used for the same function. (emphasis added, *See*, M.P.E.P. §2144.04). Thus, the intended purpose, and the fact that the elements meet that intended purpose, must be known in the art. The intended purpose of these elements (*e.g.*, prevention of corrosion by fluorine cleaning gas and avoiding the excessive use of quartz or sapphire) is not taught in the references or supplied in the Office Action. The Examiner does supply a general function that the elements could supply; however, as is clear from the specification and the claims themselves, the intended purpose or function of these elements is more than what the Examiner has recited. The Examiner must supply a reference(s) that teaches that the intended purpose (*e.g.*, prevention of corrosion in the recited context, avoiding the excessive use of quartz or sapphire, etc.) of these elements was known and that the recited elements had these characteristics in order for the rejection to be adequate.

The Examiner is reminded that "obviousness can only be established ... where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art." (M.P.E.P. §2143.01). Moreover, "[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)." (M.P.E.P. §2143.01). The Examiner has failed to supply a motivation for why one of skill in the art would have made the particularly recited combinations, and has merely put forth what amounts to an "obvious to try" rationale.

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Applicants note that the only motivation supplied by the Examiner regarding the modifications of Shang to use the capacitively coupled structure of Igarashi is that it was “shown to be a suitable means in which to energize gas into plasma.” (Office Action, page 3). Applicants note that no reason is supplied as to why one of skill in the art would have selected this item to so modify, to modify the element as recited in the Office Action, or that the purpose of this element was recognized in the references. For example, one purpose of using aluminum walls is that quartz and sapphire are no longer required (*see, e.g.*, 0019). The Examiner has failed to supply a reference that teaches this as a desirable goal for fluorine cleaning remote plasma sources.

Similarly, the only motivation supplied for using the recited frequency is that it would have been “suitable for creating reactive species.” However, no teaching is provided of the intended purposes, which are recited throughout the specification, *e.g.*, 0016, 0018, and 0019 (*e.g.*, allowing for the chamber to be made of an aluminum alloy). As the intended purpose has not been taught in the references, one of skill in the art could not have recognized that they would have been suitable for the intended purpose.

Moreover, Applicants note that the claimed combination has particular advantages over a random collection of various elements that would be suitable for the reasons set forth in the Office action. Many of these advantages are recited in the specification. Thus, the recited elements are not merely the result of the selection of a known materials based on their suitability for some general use. Rather, these elements are a particular combination that results in a superior product which can have numerous advantages over devices in the prior art. Applicants note that some of these advantages are explicitly stated in the specification, *e.g.*, no need for quartz or sapphire in the remote chamber, superior cleaning speeds of 2.0 microns/minute to greater than 2.5 microns/minute at relatively low power levels. Applicants note that they believe that these are removal rates that are greater than those previously achieved in the art (*see, e.g.*, 0026, 0131, and 0132) for the same or lower power. Applicants note that any one of these would be sufficient to establish patentability.

Additionally, Applicants note that the recited frequency of about 300 kHz to about 500 kHz is not taught by the frequency range of 10 kHz to 200 MHz. Applicants note that the range

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covers over four orders of magnitude, while the claimed range covers only a very small subsection of this range. The Applicants respectfully remind the Examiner that

if the reference's disclosed range is so broad as to encompass a very large number of possible distinct compositions, this might present a situation analogous to the obviousness of a species when the prior art broadly discloses a genus. *Id.* See also *In re Baird*, 16 F.3d 380, 29 USPQ2d 1550 (Fed. Cir. 1994); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); MPEP § 2144.08. (See M.P.E.P. §2144.05).

In the present situation, the huge range provided by the reference, which encompasses four orders of magnitude, discloses a whole genus of possible frequencies (e.g., any that may work). In comparison, the range of frequencies recited in the claims is a very narrow range, which encompasses the RF frequencies, which are capable of being transmitted through aluminum. Additionally, this huge range includes various frequencies that would not work or have the advantages that the claimed invention possesses, due to the particularly recited range. For example, the range in the reference would include microwave frequencies or other frequencies that would not work with a remote chamber with walls of aluminum alloy. Applicants note that there is no teaching in the references that the particular range has any advantage for any of the recited devices.

Rebuttal Evidence of Any Prima Facie Showing

Finally, Applicants note that, even assuming a *prima facie* case of obviousness has been established, such a showing would be rebutted by the fact that the presently claimed invention is capable of displaying superior properties. For example, the presently claimed device is capable of removing silicon nitride deposits at a rate of more than about 2.0 microns/minute with a power of less than 3,000 watts. The device can remove other compounds at rates over 2.5 microns/minute. Additionally, the following is a list of the advantages achievable from the particularly recited combination that recited in the specification:

- 1) Risk of damage during processing and problems of fluorine active species consumption is reduced.
- 2) Damage to electrodes by ion bombardment at the time of cleaning and deterioration of electrode surfaces can successfully be prevented.

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3) Complex tuning circuits are unnecessary and miniaturization of the remote plasma discharge chamber and lower cost can be realized.

4) Adsorption of fluorine active species or fluoride gas onto the internal surface of the piping or the valve can be eliminated. Thus, the occurrence of fluorine active species or fluoride gas being released from the internal surface of the piping and the valve after cleaning is completed and remaining within the remote plasma discharge chamber is reduced or eliminated. Accordingly, the occurrence of plasma ignition failure can be controlled.

5) When supply of fluorine-containing gas is stopped, fluorine active species is promptly discharged from the piping and the remote plasma discharge chamber.

6) Reduction of fluorine adsorption also increases the amount of fluorine active species brought into the reaction chamber, thereby maintaining the activity of active species and improving cleaning efficiency.

These advantages, and more, are generally recited in the specification at 0024 and 0025.

Applicants note that the elements recited in some of the dependent claims have not been addressed in the Office Action. For example, nowhere in the Office Action is there even a recitation of the element recited in Claim 14, or a statement that the element is taught in the cited references.

As not every element has been taught and an adequate motivation has not been supplied, a *prima facie* case of obviousness has not been established. Additionally, even if one had been established, it would have been rebutted by the fact that the claimed device shows superior cleaning rates, as well as the other superior or new properties listed above. As such, Claim 1 is nonobvious. As Claim 1 is nonobvious, all claims depending from Claim 1, Claims 2-10, 14-19, and 45, are also nonobvious. Applicants request that the rejection be withdrawn and Claim 1-12, 14-19, and 45 be allowed.

Rejection of Claims 5-10 under 35 U.S.C. §103(a)

Applicants note that, in addition to the above issues, a through-flow valve is not actually taught in Fujimura (U.S. Pat. No. 4,718,976). The “gas regulating device” of Fujimura is not a

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through-flow valve as disclosed in the present specification (*e.g.*, 0026 and 0115-0117). In particular, Fujimura does not teach a valve that is configured so that when it is opened, there is “no structural hindering [of the] cleaning gas flowing through the valve 15.” (0117). Through-flow valves have particular characteristics. For example, “the pressure drop across the valve is preferably less than about 0.25 Torr (or less than about 5% of the inlet pressure), more preferably less than about 0.1 Torr (or less than about 1% of the inlet pressure, and most preferably substantially no pressure loss is caused.” (Application, 0023). Thus, these valves reduce any loss in pressure that might otherwise occur. An example of a through-flow device is shown in Figures 4A and 4B of the Application. Thus, not all of the elements have been taught by the combination of the cited references and a *prima facie* case of obviousness has not been established.

Moreover, Fujimura actually teaches away from such an embodiment as it teaches a gas diffusing plate 25 which is “fixed in front of the activated gas” (FIGS. 3-5 and col. 3, lines 44-54). Indeed, the most important feature of the invention in Fujimura involves this gas diffusing means (“[t]he gas diffusing means, which constitutes the most important feature of the present invention, may comprise...diffusing plate 25...” emphasis added, col. 3, lines 42-44). Clearly, Fujimura is teaching that the gas can and should be obstructed to allow for diffusion, while the presently recited through-flow valve has the opposite effect of not restricting the flow between the remote plasma discharge chamber and the reaction chamber. (*See, e.g.*, 0026). The Examiner is respectfully reminded that “a *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997)” (M.P.E.P. §2144.05 III).

Additionally, Applicants note that Shang actually teaches that a filter 56 should be placed between the remote chamber 46 and the processing chamber. Applicants note that a filter will result in the restriction of the flow of gas. Applicants note that the use of devices to restrict the flow, either due to filters or through the valve itself, were part of the art at the time of the current invention (*see, e.g.*, 009-0011 and 0042 of the Application). For example, U.S. Pat. No. 5,788,778, suggests the use of a “flow restrictor” to prevent the free flow of gas. Using only partially opened piping was actually thought to be necessary for a variety of reasons (*e.g.*, a need

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for filters or maintaining pressure). These references teach away from the use of a flow-through valve, which can result in fully opening the piping with no resulting restriction of the flow. Applicants note that the presently recited device provides a way for avoiding the previous issues which required filters or flow restrictions. In other words, the prior art taught away from the presently recited invention because the prior art suffered from problems that required filters or other flow restricting structures. However, the currently claimed device need not suffer from those failings, and thus, can be used with a flow-through type valve.

As a flow-through valve has not been taught, and as Fujimura and Shang, as well as other references, are actually teaching away from the claimed invention, Applicants respectfully request that the rejection be withdrawn and the claims (5-10) be allowed.

Rejection of Claims 17-19 and 45 under 35 U.S.C. §103(a)

Claims 17-19 and 45 stand rejected in light of the above references and Noble et al (hereinafter "Noble") and Ikeda et al (hereinafter "Ikeda") respectively. Applicants note that the elements recited in Claim 18 have not been fully addressed in the rejection and that Noble does not teach piping that opens into the reaction chamber downstream of the inlet. As noted above, Claims 17-19 and 45 depend from Claim 1 and are likewise nonobvious.

Applicants note that the dependent claims provide additional novel and nonobvious combinations over Claim 1. Additionally, Applicants note that, unless the claims are substantively rejected in the office action, the Applicants believe that they represent allowable subject matter (*e.g.*, Claims 14 and 18). If this is not what is intended, Applicants request that the Examiner make of record the reasons and support for the rejections.

CONCLUSION

In view of the foregoing amendments and arguments, Applicants submit that the application is now in condition for allowance and respectfully request the same. If, however, the Examiner feels some issue remains that can be addressed by Examiner Amendment, the Examiner is cordially invited to call the undersigned for authorization.

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Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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